STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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COMMISSIONER

Thermogen I, LLC **Penobscot County** **Millinocket, Maine** **A-1072-77-1-N**	**Departmental** **Findings of Fact and Order** **Air Emission License**

After review of the air emissions license application, staff investigation reports and other documents in the applicant's file in the Bureau of Air Quality, pursuant to 38 M.R.S.A., §344 and §590, the Department finds the following facts:

I. REGISTRATION

A. Introduction

Thermogen I, LLC (Thermogen) has applied for a major source Air Emission License to construct and operate a wood torrefaction processing line, consisting of a biomass Rotary Dryer, back-up biomass fired suspension burner, Targeted Intelligent Energy System (TIES) Processor, Pellet Mill, and miscellaneous supporting equipment. The process will produce torrefied wood pellets from woody biomass.

This license includes PM, SO_2, NO_X, and CO Best Available Control Technology (BACT) findings, VOC Lowest Achievable Emission Rate (LAER) findings, and VOC offsets.

The equipment addressed in this license is located at 1 Katahdin Ave, Millinocket, Maine.

The Thermogen facility will be on leased property within the wood yard area of the Great Northern West Mill (GNP Mill) site; however, the two entities will be operationally independent. They are separate legal entities under separate control with no shared products or services.

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PRESQUE ISLE, MAINE 04679-2094
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B. Emission Equipment

The following equipment is addressed in this air emission license:

Equipment

Equipment	Maximum Fuel Firing Capacity[2]	Maximum Raw Material Process Rate[2]	Maximum Finished Material Process Rate[2]	Control Device(s)	Stack #
Rotary Biomass Dryer	N/A	335,979 tpy of 45% moisture woody biomass[1] (184,788 ODT/yr)	184,788 ODT/yr[1] (dry woody biomass)	Cyclone and Wet ESP	1
Back-up Wood Suspension Burner	40 MMBtu/hr (4706 lb/hr) dry woody biomass with propane startup	N/A	N/A	Cyclone and Wet ESP	1
Torrefaction (TIES) Processor	N/A	184,788 ODT/yr[1] (dry woody biomass)	110,000 tpy torrefied biomass	Thermal Oxidizer (20 MMBtu/hr propane startup)	1
Pelletizer	N/A	110,000 tpy torrefied biomass	110,000 tpy torrefied wood pellets	Cyclone	2

Table Notes:

ODT = oven dried ton

[1] Assuming maximum rated capacity and maximum annual operating hours (8760 hours/year).

[2] Equipment capacities are listed for informational purposes only and are not intended as license restrictions unless set forth in the Conditions.

Additional units proposed for the Thermogen facility, including a wet woody biomass reclaim system at the Rotary Dryer, a woody biomass transfer and fuel preparation system at the TIES dryer system feed, and a secondary gas/gas heat exchanger for heating the TIES process gases, have negligible or potential emissions below the insignificant activity thresholds in the Appendices of *Major and Minor Source Air Emission License Regulations*, 06-096 CMR 115 (as amended). Therefore, these and other insignificant activities are not addressed in this license.

C. Application Classification

A new facility is considered a major source based on whether or not expected emissions exceed the "Significant Emission Levels" as defined in the Department's regulations. The new source classification is determined by comparing the maximum future license allowed emissions to the significant emissions levels, as shown in the following table for the Thermogen facility:

Comparison of Future License Limits and Significant Emission Levels

Pollutant	Max. Future License (TPY)	Significant Emission Level
PM	24.1	100
PM_{10}	24.1	100
SO_2	0.1	100
NO_X	69.1	100
CO	55.5	100
VOC	178.3	50
CO_2e	<100,000	100,000

Table Note: The emissions were calculated based on a dryer throughput of 335,979 tpy wood with 45% average moisture content (184,788 oven dried tons per year), a 52,560 MMBtu annual total fuel heat input limit on the suspension burner, which applies only after the commencement of operating scenario #1 (52,560 MMBtu is equivalent to 1314 hours at maximum firing rate or 15% of annual capacity), 80% particulate matter control efficiency on the wet electrostatic precipitator, 99.9% volatile organic compound control efficiency from the TIES Processor through the Thermal Oxidizer, and 90% particulate matter control efficiency with a high efficiency cyclone from the pellet cooling system.

The Department has determined the facility is above the significant emissions level threshold for VOC and is classified as a major source. The application has been processed through *Major and Minor Source Air Emission License Regulations*, 06-096 CMR 115 (as amended).

As part of the amendment submittal process for a proposed major new source, a pre-application meeting with Thermogen and the Department was held on May 11, 2012, a public information meeting was held in Millinocket on May 10, 2012, and the Public Notice of Intent to File was published in the Bangor Daily News for three consecutive weeks. The Federal Land Managers (FLMs) representatives from Acadia National Park, Moosehorn National Wildlife Refuge, Roosevelt Campobello International Park, and Presidential Range/Dry River/Great Gulf Wilderness Area were notified of the project. This notification included a project summary, distances from the source to each of the Class I areas and the magnitude of proposed emissions increases on a pollutant-by-pollutant basis. In September 2012, several FLM representatives responded with determinations that Class I Air Quality Related Values (AQRV) analyses would not be required.

Thermogen shall apply for a Part 70 license under Part 70 Air Emission License Regulation, 06-096 CMR 140, Section 1(J)(2)(D) (as amended), within 12 months of commencing operation, as provided in 40 CFR Part 70.5.

II. BEST PRACTICAL TREATMENT (BPT)

A. <u>Introduction</u>

In order to receive a license, the applicant must control emissions from each unit to a level considered by the Department to represent Best Practical Treatment (BPT), as defined in *Definitions Regulation*, 06-096 CMR 100 (as amended). Separate control requirement categories exist for new and existing equipment as well as for those sources located in designated non-attainment areas.

BPT for new sources and modifications requires a demonstration that emissions are receiving Best Available Control Technology (BACT), as defined in *Definitions Regulation*, 06-096 CMR 100 (as amended). BACT is a top-down approach to selecting air emission controls considering economic, environmental and energy impacts.

A general process description is provided to give background information and an overview of the process.

Process Description

Thermogen is proposing a thermo-chemical process by which woody biomass is heated in the absence of oxygen, using a combination of microwave and thermal energy within a specially designed rotary drum to maximize heat transfer through the biomass. Water and low energy value volatiles are removed from the biomass, giving off volatile organics which are collected and combusted to provide heat for the system. The torrefied biomass is then pelletized. The end product of renewable fuel will have approximately 30% more energy content per unit of mass than regular wood pellets and will be stable and water resistant.

Woody biomass, in previously chipped or ground form with approximately 45% moisture content, will be delivered to the site and stored on a paved storage pad. The woody biomass will then be conveyed to a screen and hammermill, which will produce woody biomass sized ½ inch or less. This woody biomass will go to a metering bin via covered belt conveyor and feed into a single pass Rotary Dryer. The Rotary Dryer will dehydrate the woody biomass to a moisture content of approximately 15%. Under normal operating conditions (operating scenario #1), the heat for the dryer will be provided by the Thermal Oxidizer Combustor gases, generated downstream in the process. At startup and during periods requiring additional supplemental energy, a 40 MMBtu/hr biomass suspension burner will be used to provide Rotary Dryer heat (operating scenario #2).

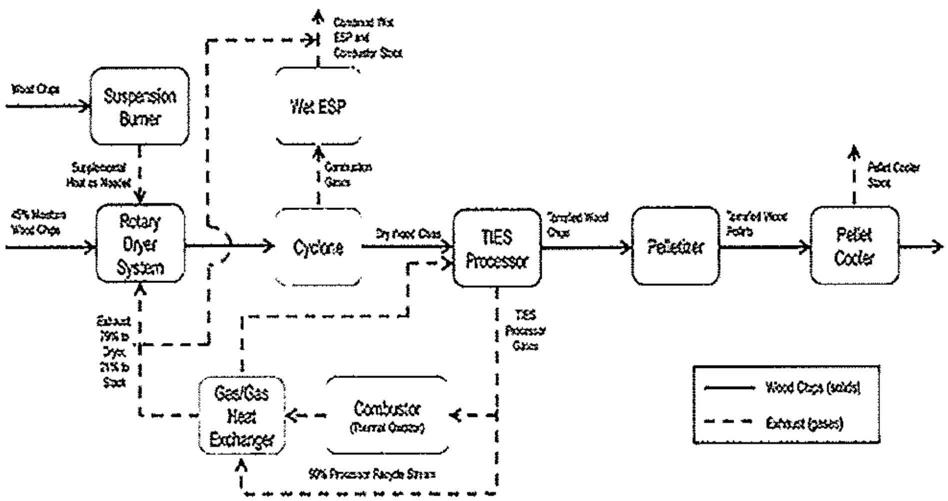
From the Rotary Dryer, the exhaust gases will be separated from the dried woody biomass via a cyclone. Combustion gases from the cyclone will pass through a low pressure drop, up-flow wet electrostatic precipitator (ESP) with an integrated water treatment system prior to being exhausted to the atmosphere. The woody biomass will travel from the cyclone to a storage and metering bin before being fed to the Targeted Intelligent Energy System (TIES) processor.

The TIES Processor will use microwave and thermal energy in an oxygen starved environment operating between 400°F to 570°F to heat and char the woody biomass. Water and low energy value organic compounds from the woody biomass will be released. These volatile organic compounds (VOCs) exhaust gases will be collected and routed through a series of heat exchangers. A recycle stream containing 90% of the gases will be returned to the TIES Processor to provide additional heat to the system. The remaining 10% of the gases will be routed to a Thermal Oxidizer Combustor. Approximately 79% of the Thermal Oxidizer Combustion gases will be routed directly back to the Rotary Dryer in the front-end of the process, providing thermal energy. The remaining 21% of the Thermal Oxidizer Combustor gases will be exhausted to the atmosphere via the wet ESP stack.

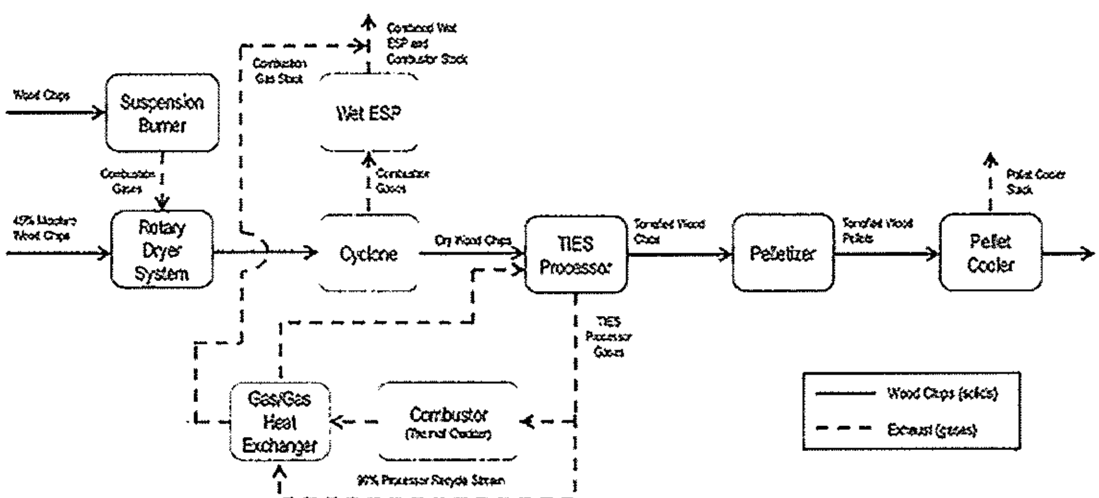
The torrefied biomass from the TIES Processor will go through a cooling screw conveyor, get sprayed with water, and enter the pellet mill. The torrefied biomass will be pelletized, collected, and cooled via a series of conveyors and a pellet cooler which exhausts through a high efficiency cyclone. The final product will then be shipped off-site.

As noted, the Rotary Dryer will have a normal operating scenario using recycled thermal energy from the process (operating scenario #1). After full commencement, operating scenario #1 will occur at a minimum of 85% of the operating time. In addition, the Rotary Dryer shall be equipped with a 40 MMBtu/hr back-up biomass fired suspension burner to be used at startup and during periods of increased dryer heat demand (i.e., high woody biomass moisture levels). The burner will also function as a back-up heat source to the Rotary Dryer in the event of a disruption to the TIES system or Thermal Oxidizer Combustor. In operating scenario #2, the biomass suspension burner will be utilized and all of the burner combustion gases will be routed to the Rotary Dryer and exhausted through the cyclone and wet ESP prior to going out the stack. Gases produced in the Thermal Oxidizer Combustor will not be recycled back to the Rotary Dryer, but will instead enter the stack after the wet ESP and be exhausted to the atmosphere. Operating scenario #2 will occur at a maximum of 15% of the operating time, based on the fuel use for the suspension burner.

A simplified diagram of operating scenario #1 is shown below.



A simplified diagram of operating scenario #2 is shown below.



B. Federal Regulations

The proposed facility has the potential to be subject to federal rules promulgated under 40 CFR Part 60 and 40 CFR Part 63.

1. New Source Performance Standards, 40 CFR Part 60, Subpart Dc

   40 CFR Part 60, Subpart Dc, *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units*, is applicable to steam generating units greater than or equal to 10 MMBtu/hr and less than or equal to 100 MMBtu/hr for which construction, modification, or reconstruction occurred after June 9, 1989. Steam generating unit is defined in 40 CFR Part 60, Subpart Dc as "a device that combusts any fuel and produces steam or heats water or heats any heat transfer medium. This term includes any duct burner that combusts fuel and is part of a combined cycle system. This term does not include process heaters as defined in this subpart."

   The Rotary Dryer's wood-fired suspension burner and the TIES Processer do not use heat transfer mediums; therefore, 40 CFR Part 60, Subpart Dc is not applicable to these two pieces of equipment since they are not considered steam generating units.

   The Thermal Oxidizer Combustor does utilize a heat transfer medium, meeting the definition of a steam generating unit. The Thermal Oxidizer Combustor may be subject to the applicable requirements of 40 CFR Part 60, Subpart Dc.

2. National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 63, Subpart JJJJJJ

   40 CFR Part 63, Subpart JJJJJJ, *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources* is applicable to all new, reconstructed, and existing boilers firing coal, biomass, or oil located at an area source of hazardous air pollutants (HAPs). Thermogen is an area source for HAPs, with the facility's potential to emit less than 10 tons per year of a single HAP and 25 tons per year combined HAPs. The definition of boiler in 40 CFR Part 63, Subpart JJJJJJ states: "Boiler means an enclosed device using controlled flame combustion in which water is heated to recover thermal energy in the form of steam or hot water. Controlled flame combustion refers to a steady-state, or near steady-state, process wherein fuel and/or oxidizer feed rates are controlled. Waste heat boilers are excluded from this definition." The Rotary Dryer's wood-fired suspension burner, the TIES Processer, and the Thermal Oxidizer Combustor do not heat water to recover thermal energy; therefore, 40 CFR Part 63, Subpart JJJJJJ is not applicable to these units since they are not considered boilers.

C. Biomass Rotary Dryer

The proposed Rotary Dryer will be a single pass unit operated to reduce the moisture content of incoming woody biomass from an annual average moisture content of 45% to approximately 15% moisture. The dryer system is designed to process woody biomass at a rate of 42,189 oven dried pounds per hour (184,788 ODT/yr at 100% annual capacity factor). The primary heat source for the Rotary Dryer will be the combustion gases from the TIES Processor Thermal Oxidizer Combustor, considered operating scenario #1. The Rotary Dryer will also have a 40 MMBtu/hr biomass fired suspension burner to be used as a back-up heat source during start-ups and malfunctions, or to be used for periodic supplemental heat (operating scenario #2). The suspension burner will have a limited capability to start up on propane gas. The exhaust from the Rotary Dryer system will exit through a cyclone and wet ESP prior to being released to the atmosphere through Stack #1. Stack #1 is proposed to be at a height of 150 feet above ground level with an inside diameter of 7 feet. An abort stack is proposed after the cyclone, but before the wet ESP.

Thermogen submitted a BACT analysis for PM, NO_X, SO_2, and CO, and a LAER analysis for VOC from the biomass Rotary Dryer and suspension burner. The BACT write-up for the wood Rotary Dryer and suspension burner also includes the NO_X, SO_2, and CO combustion emissions from the TIES Processor Thermal Oxidizer Combustor since the facility's equipment is integrated (the exhaust of one is used as the heat source for the other). EPA's RACT/BACT/LAER Clearinghouse (RBLC) and recently licensed biomass-fired burner and dryer systems located in New England were reviewed for requirements on similar units.

The following table contains the results of the RBLC and similar source license review:

Summary of Licensed New England Biomass Burners and Dryers

Facility	State	Capacity	Control Methods	Emission Limits				
				PM	NO_X	SO_2	CO	VOC
Beaver Wood Energy Fair Haven, LLC	VT	30 MMBtu/hr, 11 ODT wood fired dryer	Cyclone & Baghouse	0.2 lb/ODT	0.35 lb/MMBtu	0.025 lb/MMBtu	0.69 lb/ODT	0.35 lb/MMBtu
Great Northern Paper, LLC	NH	5 MMBtu/hr, 3.26 ODT wood fired dryer	Cyclones	9.0 lb/hr	0.33 lb/MMBtu	-	-	-
Northeast Pellets	ME	12 MMBtu/hr sawdust fired triple pass dryer	Cyclone & 800°F Dryer Inlet Temp.	0.3 lb/MMBtu	-	-	-	20 lb/hr

Geneva Wood Fuels, LLC	ME	40 MMBtu/hr, wood fired dryer	Multiple Cyclones and Good Comb-ustion Practices	8.5 lb/hr	10.8 lb/hr	1.878 lb/hr, 0.047 lb/MMBtu	10.8 lb/hr	9.7 lb/hr
Deposit Wood Pellet LLC	NY	15 ODT/hr wood fired rotary kiln dryer	Multiple Cyclones	0.05 gr/cf	-	-	-	8.55 lb/hr
Maine Woods Pellet Company	ME	50 MMBtu/hr wood fired dryer	Cyclones & Wet Scrubber	8.5 lb/hr	12.3 tpy	12.5 tpy	37 tpy	12.5 lb/hr
Presby North Country Wood Pellets, Inc.	NH	20 MMBtu/hr, 8 ODT/hr wood fired dryer	Multiple Cyclones	16.5 lb/hr	-	-	-	-
Woodstone NY, LLC	NY	38 MMBtu/hr, 13.2 ODT/hr wood fired rotary kiln dryer	Multiple Cyclones	0.05 gr/cf	22.5 lb/hr	-	-	11.25 lb/hr
Corinth Wood Pellets	ME	20 MMBtu/hr, 11.1 ODT/hr wood fired rotary dryer	Two Cyclones, Good Comb-ustion Practices	25.5 lb/hr softwood; 30 lb/hr hardwood	5.7 lb/hr	0.5 lb/hr	-	23.3 lb/hr softwood; 11.1 lb/hr hardwood
New England Wood Pellet, LLC	NH	40 MMBtu/hr, 10.2 ODT/hr wood fired rotary dryer	Multiple Cyclones	0.3 lb/MMBtu	-	-	-	-
Schulyer Wood Pellet LLC	NY	50 MMBtu/hr, 15 ODT/hr wood fired rotary kiln dryer	Multiple Cyclones & 1700˚F Dryer Inlet Temp.	0.42 lb/MMBtu	-	-	-	10.5 lb/hr

1. BACT (Best Available Control Technology) Findings

   The data obtained from the RBLC and similar sources license review, along with information on the economic impact, technical feasibility, and environmental impact of various control options, was used to determine the available control technologies and corresponding levels of control for the wood Rotary Dryer and suspension burner.

The following summarizes the BACT findings for the biomass Rotary Dryer and suspension burner, also including the SO_2, NO_X, and CO combustion gases from the TIES Processor Thermal Oxidizer Combustor:

PM/PM_{10} – Particulate matter emissions from biomass dryers are primarily generated through evaporation of the wood, with some PM generated from incomplete combustion of fuel and non-combustible material in the fuel. PM emissions can also be formed when condensation occurs at normal atmospheric temperatures after the vapor emissions leave the dryer stack, creating a visible blue haze. The quantity of PM emissions from a biomass dryer can be dependent upon wood species being dried, dryer temperature, fuel used in the burner, and additional factors such as seasonal moisture variations and wood storage time.

Potential particulate matter controls for direct fired rotary biomass dryers consists of add-on controls, combustion of clean fuels, good combustion and operating practices, or a combination of options. The evaluation of add-on controls for this Rotary Dryer and burner included electrostatic precipitators (ESPs), thermal oxidizers, fabric filters/baghouses, absorption systems (wet scrubbers), exhaust gas recycle (afterburner), and cyclone(s).

Thermal oxidizers destroy condensable PM by burning the exhaust gas at high temperatures and they can also reduce CO emissions in direct-fired dryer exhausts by oxidizing the CO in the exhaust to CO_2. Regenerative thermal oxidizers preheat the inlet emission stream with heat recovered from the incineration exhaust gases. The inlet gas stream is passed through preheated ceramic media and an auxiliary gas burner is used to reach temperatures between 1450°F and 1600°F at a specific residence time. The combusted gas exhaust then goes through a cooled ceramic bed where heat is extracted. The average capital cost of a regenerative thermal oxidizer for PM control is estimated to be $2,200,000 with an annualized cost of $380,000. The economics of a 98% PM reduction from 21.91 tons of PM (this number excludes the pellet mill emissions) is not economically feasible for this project.

Baghouses collect particulate matter on the surface of filter bags which are periodically cleaned or replaced to maintain an efficiency of greater than 80%. Baghouses can theoretically control PM emissions from wood dryers, but moisture considerations can make them impractical for wood dryer applications. The capital costs can range from $400,000 to $1,000,000 depending on fabric material, configuration, and cleaning mechanisms. Annualized operating costs can be as high as $400,000 with extensive maintenance and replacement costs. Regardless of the economics, the gas stream's high moisture content in conjunction with the heavy molecular weight organic content of the gas stream causes baghouses to be technically infeasible for the proposed dryer system.

ESPs consist of charging particles in the exhaust stream with a high voltage, oppositely charging a collection surface where the particles accumulate, removing the collected dust by a rapping process, and collecting the dust in hoppers. Wet ESPs utilize a pre-quench to cool and saturate the gases prior to entering the ESP. The wet ESP collects only particles and droplets that can be electrostatically charged, and does create wastewater effluent. The wet ESP technology has been determined to be feasible and has been selected as part of the BACT strategy for the proposed dryer system.

Wet scrubbers consist of using particle inertia and pressure to transfer particles from the gas stream to a liquid stream using water, purging the liquid, and removing the particles in sludge form. Either a fiber bed or packed bed media is used with liquid circulation. Exhaust gases pass through the wetted media where PM is stripped out. Design considerations include inlet air stream characteristics, availability of a suitable solvent, removal efficiency requirements, treating and disposing of the liquid waste stream, protecting the system against freezing in colder weather, and maintaining low pressure drop to minimize the potential for plugging. A wet scrubber was found to be infeasible due to the economics of the capital and ongoing operational costs; as well as having a lower control efficiency as compared to the other considered options, and the environmental issues of make-up water requirements and waste sludge disposal.

An afterburner typically recycles exhaust gases from a flue stack into an oversized combustion unit designed to accommodate up to 100% recirculation of exhaust gases. The recirculated dryer exhaust is mixed with combustion air and exposed directly to the burner flame where organic particulate emissions are incinerated. Exhaust gas recycle systems (afterburners) are generally designed as part of the process and not as add-ons or retrofit due to the nature of the control. Afterburner systems can cost as much as $1,000,000 to install making it cost prohibitive for the dryer system.

Cyclones, normally an integral part of rotary drum biomass dryers, are a very common particulate control device used in many applications. Cyclones utilize centripetal force to separate particles from gas streams, especially where relatively large particles need to be collected. Cyclones are commonly constructed of sheet metal, have relatively low capital cost, low operating costs, and no moving parts. The use of a cyclone has been determined to be feasible and has been selected as part of the BACT strategy for the proposed dryer system.

Good combustion practices can reduce products of incomplete combustion, including particulate matter. The use of a new, efficient, clean burning burner and good combustion practices can minimize PM emissions and has been selected as part of the BACT strategy for the proposed dryer system.

The following summarizes the PM control technology rankings:

Dryer System PM Control Technology Rankings

Control Technology	% PM/PM_{10} Control	Technical Feasibility	Economic Feasibility
Thermal Oxidizer	98+	Feasible	Cost prohibitive ($2,200,000 capital $380,000 annual)
Baghouse (fabric filter)	80+	Infeasible	N/A
ESP/Wet ESP ***SELECTED***	80+	Feasible	Feasible
Wet Scrubber	50+	Feasible	Cost prohibitive ($825,000)
Exhaust Gas Recycle (thermal oxidation for portion of gas stream)	40-60	Feasible	Cost Prohibitive ($1,000,000)
Cyclone(s) ***SELECTED***	Variable	Feasible	Feasible
Good Combustion Practices ***SELECTED***	General Minimization of Emissions	Feasible	Feasible

BACT for PM/PM_{10} emissions from the Rotary Dryer and suspension burner is the use of a cyclone, a wet electrostatic precipitator, good combustion and operating practices, an annual total fuel heat input capacity restriction on the suspension burner operation, and the following emission limits:

PM/PM_{10} BACT Emission Limits

Operating Scenario	PM/PM_{10} Emission Limit from Stack #1
Operating Scenario #1 – Heat derived exclusively from the TIES thermal oxidizer combustor	3.9 lb/hr
Operating Scenario #2 – Heat derived from the suspension burner (also includes TIES combustor emissions entering the stack after the wet ESP)	11.3 lb/hr

The PM/PM_{10} emission limits are also more stringent than the particulate matter limit found in *General Process Source Particulate Emission Standard* 06-096 CMR 105 (as amended). The 06-096 CMR 105 limit for processing approximately 40,000 lb/hr of material is a 22.3 lb/hr emission rate. The BACT PM/PM_{10} emission limit for the Rotary Dryer is below the 06-096 CMR 105 limit.

Note that when the primary heat source for the dryer is the TIES Processor Thermal Oxidizer Combustion gas (operating scenario #1), all exhaust will go through the cyclone and wet ESP. When the primary heat source for the dryer is the suspension burner (operating scenario #2), the dryer's exhaust will go through the cyclone and wet ESP, but the TIES Thermal Oxidizer Combustion gas will be discharge to the stack after the wet ESP.

SO_2 – Sulfur dioxide is formed from the combustion of sulfur present in the fuel. Control options for SO_2 include removing the sulfur from the flue gas by adding a caustic scrubbing solution or restricting the sulfur content of the fuel. The wood fuel fired in the suspension burner is inherently a low sulfur fuel, with only trace amounts of sulfur available to combine with oxygen in the combustion process. The use of propane gas for burner startup is also considered a low sulfur fuel. Additional sulfur controls are not justified for the dryer system.

BACT for SO_2 emissions from the Rotary Dryer and suspension burner is the firing of clean wood/woody biomass materials including wood chips, bark, shavings, and sawdust; the use of propane gas for burner startup; and the following emission limits:

SO_2 BACT Emission Limits

Operating Scenario	SO_2 Emission Limit from Stack #1
Operating Scenario #1 – Heat derived exclusively from the TIES thermal oxidizer combustor	0.01 lb/hr
Operating Scenario #2 – Heat derived from the suspension burner (also includes TIES combustor emissions entering the stack after the wet ESP)	0.01 lb/hr

NO_X – Nitrogen oxide is generated from fuel NO_X, thermal NO_X, and prompt NO_X. Oxidation radicals near the combustion flame forms prompt NO_X in insignificant amounts. Reducing NO_X formation from the two other NO_X generating mechanisms includes firing a low nitrogen content fuel to minimize fuel NO_X and maintaining combustion temperatures below 3600°F to minimize thermal NO_X. Add-on NO_X control options consist of selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). Combustion control techniques for NO_X emission reductions include staged combustion, burner modifications, low excess air firing, flue gas recirculation, and combustion of clean fuels.

Add-on SCR and SNCR controls are primarily used on large industrial and utility boilers. SCR and SNCR reduce NO_X emissions through the injection of urea or ammonia in the gas exhaust stream under specific temperature ranges. There were no SCR or SNCR installations on biomass boilers sized 19.4 to 69.3 MMBtu/hr listed in the RBLC database. Control installation costs, annual operating costs, added energy consumption, and operation and maintenance costs are not economically feasible for this size project.

Flue gas recirculation and low NO_X burners are utilized on larger boilers. Flue gas recirculation requires ductwork from the burner outlet duct to the combustion air duct, reducing peak flame temperatures. Flue gas recirculation and low NO_X burners are not typically economically feasible on smaller wood fired units.

BACT for NO_X emissions from the Rotary Dryer and suspension burner is the firing of clean wood/woody biomass materials including wood chips, bark, shavings, and sawdust (having inherently low nitrogen content); the limited use of propane gas for burner startup; an annual total fuel heat input capacity restriction on the suspension burner operation; good combustion practices; and the following emission limits:

NO_X BACT Emission Limits

Operating Scenario	NO_X Emission Limit from Stack #1
Operating Scenario #1 – Heat derived exclusively from the TIES thermal oxidizer combustor	13.0 lb/hr
Operating Scenario #2 – Heat derived from the suspension burner (also includes TIES combustor emissions entering the stack after the wet ESP)	31.50 lb/hr

CO – Carbon monoxide emissions are a result of incomplete combustion, caused by conditions such as insufficient residence time or limited oxygen availability. CO emissions from units with burners are typically minimized by good combustion, although oxidation catalyst systems have been used on larger units. Thermal oxidation is also an option for add-on CO control.

An oxidation catalyst lowers the activation energy needed for CO to react with available oxygen in the exhaust to produce CO_2. In order to prevent the occurrence of particulate contamination in a biomass system, the oxidation catalyst would need to be located after the particulate matter control technology; however, then the process exhaust gas must typically be preheated prior to contact with the catalyst bed. The cost of the oxidation catalyst, the associated need for a preheat burner, and the biomass plugging potential does not result in an oxidation catalyst as a feasible option for the dryer system.

Thermal oxidation reduces CO emissions in the flue gas with high temperature post combustion. The application of a second thermal oxidizer at Thermogen would require additional fuel usage, would result in additional secondary emissions, and would have a large economic impact on the project. There were no CO thermal oxidizer installations on the biomass boilers reviewed in the RBLC database. A thermal oxidation for CO controls is not a feasible option for the dryer system.

Good combustion efficiency and proper equipment operation and maintenance incorporate various techniques to minimize CO emissions.

Proper combustion techniques include maintaining optimum combustion conditions within the system via optimization of residence time, temperature, and mixing. Proper maintenance includes keeping the air to fuel ratio at the manufacturer's specified settings, and having proper air and fuel pressures at the burner.

BACT for CO emissions from the Rotary Dryer and suspension burner is the use of good combustion techniques, proper equipment maintenance, an annual total fuel heat input capacity restriction on the suspension burner operation, and the following emission limits:

CO BACT Emission Limits

Operating Scenario	CO Emission Limit from Stack #1
Operating Scenario #1 – Heat derived exclusively from the TIES thermal oxidizer combustor	11.0 lb/hr
Operating Scenario #2 – Heat derived from the suspension burner (also includes TIES combustor emissions entering the stack after the wet ESP)	22.1 lb/hr

VOC – Volatile Organic Compounds are addressed in the facility-wide LAER section of this license's Finding of Fact.

GHG – Greenhouse gas emissions are minimized by the use of lower carbon content fuel. Wood/biomass fuel is classified as biogenic and EPA has deferred addressing biogenic related GHG emissions for at least another two years until their analysis of the carbon neutrality of various types of biogenic fuel has been completed. Based on the use of biomass fuel, the size and efficiency of the burner, and the estimated potential GHG emissions from the unit (below major source licensing thresholds), no specific GHG emission limits are required for dryer system at this time.

Opacity - Visible emissions from Stack #1 shall not exceed 30% opacity on a 6-minute block average, except for no more than two 6-minute block averages in a continuous three hour period.

Additional BACT Findings –

The suspension wood burner shall be limited to a total fuel heat input capacity of 52,560 MMBtu/yr (equivalent to 1314 hours/year at maximum firing rate or 15% of annual capacity). The total fuel heat input capacity limit shall also include the small amount of startup propane used in the burner.

The use of propane in the suspension burner may be used at startup and stabilization periods.

The Rotary Dryer shall not exceed a processing rate of 184,788 tons per year of wood on a 0% moisture basis, on a 12-month rolling total basis.

A temperature monitoring system shall be installed, operated, maintained, and calibrated on the Rotary Dryer in accordance with the manufacturer's recommendation.

The exhaust from the Rotary Dryer (including the suspension burner, when operating) shall exit through the cyclone and wet ESP except during periods of startup, shutdown, or malfunction when the exhaust may be diverted through the associated abort stack. Use of the abort stack during startup, shutdown, and malfunctions shall be minimized to the greatest extent practicable, with no period extending longer than 3 hours.

Within 180 days of commencing operating scenario #1 (TIES Processor Thermal Oxidizer Combustor gases used as the sole heat source of the Rotary Dryer and producing torrefied woody biomass pellets), Thermogen shall submit the following to the Department:

- A startup, shutdown, and malfunction plan to the Department detailing emissions, procedures, and timeframes for these events.
- Documentation on the Rotary Dryer inlet temperature parameter values. The inlet temperature parameters shall ensure proper operating conditions of the dryer.
- A plan detailing Wet ESP parameter values and monitoring frequency to the Department for approval. These parameters shall ensure proper operating conditions of the Wet ESP.

After review of the submitted plans and documentation, the Department shall require Thermogen to submit a license application to incorporate the specifics of the facility's operations during startup and shutdowns, the dryer's inlet temperature parameters, and the Wet ESP parameter requirements into the license.

Once commencement of operating scenario #1 occurs, the 180 day period as referenced in the above paragraph is necessary to allow the facility a shake-down period during which the innovative torrefication process can be brought fully on-line and the operational parameters can be determined. The operating scenario #1 commencement shall be defined as when the TIES Processor Thermal Oxidizer Combustor gases are used as the sole heat source of the Rotary Dryer and the facility is processing torrefied woody biomass pellets. The operating scenario #1 commencement shall occur within 180 days of first fire of the suspension burner and production of dried woody biomass.

2. Periodic Monitoring -

Records shall be maintained documenting fuel use on a monthly basis. Using the fuel use information, records shall be maintained documenting compliance with the 52,560 MMBtu total fuel heat input limit on a 12-month rolling total basis.

Records shall be maintained documenting propane fuel use for startup or stabilization purposes.

Records shall be maintained to document compliance with the processing rate limit of 184,788 tons per year of wood at 0% moisture basis, on a 12-month rolling total basis. Raw material consumption shall be determined based on wood delivery receipts, recorded moisture content, and/or Rotary Dryer feed metering. Records shall be kept on a monthly and 12-month rolling total basis.

Thermogen shall monitor and record the inlet temperature of the Rotary Dryer on a continuous basis for a minimum of 98% of the time the dryer is operating. The inlet temperature records shall include the temperature, date, and time. For the purpose of this requirement, continuous shall be defined as at least two data points every 15 minutes.

Records shall be maintained documenting startups, shutdowns, and malfunctions. These records shall include dates, times, and duration of use of the Rotary Dryer abort stack to document compliance with the 3 hour limit for each event.

Within 180 days of commencing operating scenario #1 (TIES Processor Thermal Oxidizer Combustor gases used as the sole heat source of the Rotary Dryer and producing torrefied woody biomass pellets), Thermogen shall perform stack testing on Stack #1 for PM, NO_X, CO, and VOC to determine compliance with the licensed emission limits.

D. Targeted Intelligent Energy System (TIES) Processor

The proposed TIES Processor will use microwave and thermal energy in combination with a ceramic drum to heat dried woody biomass in the absence of oxygen to produce a high energy content torrefied biomass. The innovative TIES Processor equipment is not yet operational anywhere in the United States on a commercial scale. The TIES Processor will primarily release a pyrolysis gas consisting of PM and VOCs.

The TIES Processor gas will go through a Thermal Oxidizer Combustor and this exhaust gas will be the primary heat for the Rotary Dryer under normal conditions (operating scenario #1), exiting to the atmosphere through Stack #1 after passing through the cyclone and wet ESP. In operating scenario #2, the exhaust gas from the Thermal Oxidizer Combustor will not be used in the Rotary Dryer, but will be routed to Stack #1 after the wet ESP. The thermal oxidizer combustion system includes heat exchangers and a 20 MMBtu/hr propane burner for startups. The TIES Processor and the TIES Processor Thermal Oxidizer Combustor will each be connected to an abort stack.

Thermogen submitted a BACT analysis for PM, NO_X, SO_2, and CO, and a LAER analysis for VOC from the TIES Processor. Note that combustion pollutants NO_X, SO_2, CO, and GHG from the TIES Processor Thermal Oxidizer Combustor were addressed in the Rotary Dryer and suspension burner BACT write-up section in this license. To address process emissions from the TIES Processor, Thermogen reviewed EPA's RACT/BACT/LAER Clearinghouse (RBLC) for charcoal manufacturing retort furnaces, a similar-type process.

The following table contains the results of the RBLC review:

RBLC Information for Charcoal Manufacturing Retort Furnaces

Facility	State	Equipment	Control Methods	Emission Limits			
				PM	NO_X	SO_2	VOC
Kingsford Manufacturing Company	MS	Retort Furnace 33.6 ODT/hr	Multiple Cyclones & Thermal Oxidizer	1.62 lb/ton dry wood (3 hr ave)	3.1 lb/ton dry wood (3 hr ave)	0.72 lb/ton dry wood (3 hr ave)	0.24 lb/ton dry wood (3 hr ave)
Kingsford Manufacturing Company	KY	Retort Furnace 33.6 ODT/hr	Multiple Cyclones & After Combustion Chamber	48.48 lb/hr	92.71 lb/hr	24.24 lb/hr	7.13 lb/hr

1. BACT (Best Available Control Technology) Findings

The data obtained from the RBLC, along with information on the economic impact, technical feasibility, and environmental impact of various control options, was used to determine the available control technologies and corresponding levels of control for the TIES Processor.

The following summarizes the BACT findings for the TIES Processor emissions:

PM/PM_{10} – Particulate matter emissions will be generated in the TIES process through incomplete combustion due to an intentionally oxygen starved environment, evaporation from the wood, and non-combustible material (ash). The quantity of PM emitted depends on wood species and pyrolysis operating parameters such as temperature, residence time, and oxygen content.

Potential particulate matter controls for high PM concentration pyrolysis gas streams include electrostatic precipitators (ESPs), thermal oxidizers, fabric filters/baghouses, absorption systems (wet scrubbers), exhaust gas recycle, and cyclones.

Thermal oxidizers control condensable PM by burning the exhaust gas at high temperatures. A Thermal Oxidizer Combustor has been selected as part of the BACT strategy for the proposed TIES Processor. All of the TIES Processor exhaust gases will be routed through the Thermal Oxidizer Combustor. Minimal auxiliary fuel (propane) will be needed to maintain the proper operating temperatures, except during startup.

Baghouses collect particulate matter on the surface of regularly cleaned/replaced filter bags and can theoretically control PM emissions from a torrefied wood processer, but moisture and high organic content is a significant consideration. High costs, a high moisture content gas stream, a heavy molecular weight organic content of the gas stream, and the design of the torrefication process (using exhaust gases from the TIES Processor as heat for the Rotary Dryer) causes baghouses to be technically infeasible for the proposed TIES Processor.

ESPs (using high voltage to collect charged particles) and wet ESPs (utilizing a pre-quench to cool and saturate the gases prior to entering the ESP), could be used to control the TIES Processor PM emissions that accept electric charges. Because the wet ESP technology has been selected for the proposed dryer system, the TIES Processor gases will also be controlled by the wet ESP under normal operations when the TIES Processor gases are utilized in the dryer (operating scenario #1).

Wet scrubbers could be used to control PM emissions from the TIES Processor. However, wet scrubbers were found to be infeasible for the TIES Processor for the same reasons as stated for the dryer system: economics of the capital and ongoing operational costs; and the environmental issues of make-up water requirements, potential plugging, cold weather concerns, and waste sludge disposal. Additionally, the design of the torrefication process (using exhaust gases from the TIES Processor as heat for the Rotary Dryer), causes wet scrubbers to be technically infeasible for the proposed TIES Processor.

Cyclones separate particles from gas streams using centripetal force. The use of a cyclone has been selected for the proposed dryer system; therefore, the TIES Processor gases will also be controlled by the cyclone under normal operations when the TIES Processor gases are utilized in the dryer (operating scenario #1).

The following summarizes the PM control technology rankings for the TIES Processor:

TIES Processor PM Control Technology Rankings

Control Technology	% PM/PM_{10} Control	Technical Feasibility	Economic Feasibility
Thermal Oxidizer ***SELECTED***	98+	Feasible	Feasible
Baghouse (fabric filter)	80+	Infeasible	N/A
ESP/Wet ESP ***SELECTED***	80+	Feasible	Feasible
Wet Scrubber	50+	Infeasible	Cost prohibitive ($825,000)
Cyclone(s) ***SELECTED***	Variable	Feasible	Feasible

BACT for PM/PM_{10} emissions from the TIES Processor is the use of a Thermal Oxidizer Combustor on the TIES Processor exhaust. Emissions shall be routed through a cyclone and a wet electrostatic precipitator when the TIES processor Thermal Oxidizer Combustor exhaust is utilized in the Rotary Dryer (operating scenario #1).

The TIES Processor Thermal Oxidizer Combustor exhaust is included in Stack #1 emissions along with the Rotary Dryer emissions: 3.9 lb/hr during operating scenario #1 (TIES Processor Thermal Oxidizer

Combustor exhausts through the Rotary Dryer) and 11.3 lb/hr during the operating scenario #2 (TIES Processor Thermal Oxidizer Combustor exhausts through Stack #1 after the wet ESP)

VOC – Volatile Organic Compounds are addressed in the facility-wide LAER Section of this license's Finding of fact.

Additional BACT Findings –

The use of propane in the TIES Processor Thermal Oxidizer Combustor may be used primarily at startup and stabilization periods.

The exhaust from the TIES Processor shall be directed to a Thermal Oxidizer Combustor, except during periods of startup, shutdown, or malfunction when the exhaust may be diverted through the associated abort stack. Use of the abort stack during startup, shutdown, and malfunctions shall be minimized to the greatest extent practicable, with no period extending longer than 3 hours.

Within 180 days of commencing operating scenario #1 (TIES Processor Thermal Oxidizer Combustor gases used as the sole heat source of the Rotary Dryer and producing torrefied woody biomass pellets), Thermogen shall submit the following to the Department:

- A startup, shutdown, and malfunction plan to the Department detailing emissions, procedures, and timeframes for these events.
- A plan detailing Thermal Oxidizer Combustor parameter values and monitoring frequency to the Department for approval. These parameters shall ensure proper operating conditions of the Thermal Oxidizer Combustor.

After review of the submitted plans, the Department shall require Thermogen to submit a license application to incorporate the specifics of the facility's operations during startup and shutdowns, and the Thermal Oxidizer Combustor parameter requirements into the license.

2. Periodic Monitoring -

Records shall be maintained documenting propane fuel use for startup or stabilization purposes.

Records shall be maintained documenting startups, shutdowns, and malfunctions. These records shall include dates, times, and duration of use of the TIES Processor abort stack to document compliance with the 3 hour limit for each event.

Thermogen shall comply with the applicable requirements of 40 CFR Part 60, Subpart Dc, including notification and recordkeeping.

E. Facility LAER (Lowest Achievable Emission Rate) Findings

The VOC emissions from Thermogen are subject to a Lowest Achievable Emission Rate (LAER) analysis, since VOC emissions from the facility are above the significant emission level and the facility is located in the Ozone Transport Region. Per the definition in 06-096 CMR 100 (as amended), LAER is the more stringent rate of emissions based on (1) the most stringent emission limitation contained in the implementation plan of any State for that class or category of source, unless the owner or operator of the proposed source demonstrates that those limitations are not achievable; or (2) the most stringent emission limitation which is achieved in practice by that class or category of source, whichever is more stringent.

Volatile organic compounds (VOC) will be generated in the Thermogen process through incomplete combustion and evaporation of the naturally occurring VOCs in the wood. Emission quantities depend on wood species and pyrolysis operating parameters such as temperature, residence time, and oxygen content.

The options for controlling volatile organic compounds from high concentration VOC pyrolysis gas streams include thermal destruction, electrostatic precipitators, and adsorption systems.

Thermal oxidizers destroy VOCs by burning the exhaust gas at high temperatures and they can also reduce VOC emissions in direct-fired dryer exhausts by oxidizing the VOC in the exhaust to H_2O and CO_2. The large amount of VOCs in the TIES Processor exhaust make this technology for VOC control feasible and the use of a Thermal Oxidizer Combustor has been selected for the proposed TIES Processor exhaust.

An ESP's primary function is to control particulate matter; however, secondary VOC control may be achieved. ESPs control emissions by charging particles in the exhaust stream with a high voltage, oppositely charging a collection surface where the particles accumulate, removing the collected dust by a rapping process, and collecting the dust in hoppers. Wet ESPs utilize a pre-quench to cool and saturate the gases prior to entering the ESP. The pre-quench section of the wet ESP may scrub and quench some fraction of the highly water-soluble compounds such as formaldehyde and methanol. The wet ESP technology has been selected as part of the PM BACT strategy for the facility and will be utilized for VOC control as well.

Wet scrubbers consist of using particle inertia and pressure to transfer fine and/or soluble VOCs from the gas stream to a liquid stream using water, purging the liquid, and removing the VOC in sludge form. Either a fiber bed or packed bed media is used with liquid circulation. Exhaust gases pass through the wetted media where VOC is stripped out. A wet scrubber was found to be infeasible due to the economics of the capital and ongoing operational costs; as well as the environmental issues of make-up water requirements and waste sludge disposal.

The following summarizes the VOC control technology rankings for the torrefication process:

TIES Processor VOC Control Technology Rankings

Control Technology	% VOC Control	Technical Feasibility	Economic Feasibility
Thermal Oxidizer ***SELECTED***	99.9+	Feasible	Feasible
Wet Scrubber	50+	Feasible	Cost prohibitive ($825,000)
ESP/Wet ESP ***SELECTED***	Variable	Feasible	Feasible

LAER for VOC emissions from the torrefication process is the use of a Thermal Oxidizer Combustor on the TIES Processor exhaust, in conjunction with a cyclone and wet electrostatic precipitator on the Rotary Dryer exhaust. When the TIES Processor Thermal Oxidizer Combustor exhaust is utilized in the Rotary Dryer (operating scenario #1), the exhaust will go through the cyclone and wet ESP. When the TIES Processor Thermal Oxidizer Combustor exhaust is not utilized in the Rotary Dryer (operating scenario #2), the exhaust will enter stack 1 via a tie-in located after the cyclone and wet ESP. The following LAER limits apply:

VOC LAER Limits

Operating Scenario	LAER Emission Limit from Stack #1
Operating Scenario #1 – Heat derived exclusively from the TIES thermal oxidizer combustor	40.7 lb/hr
Operating Scenario #2 – Heat derived from the suspension burner (also includes TIES combustor emissions entering the stack after the wet ESP)	33.9 lb/hr

With the proposed LAER, the overall VOC control for the facility is 99.3%, as given in the table below:

Equipment	Pre-Control VOC (tpy)	Post Control VOC (tpy)	Overall VOC Control
Rotary Wood Dryer/Burner	151.1	151.1	99.3%
TIES Processor	23,077	27.2	

Thermogen is required to obtain offsets for the VOC emissions as described in section II(F) of this air emission license.

F. VOC Offsets

Thermogen must obtain offsets for the proposed VOC emissions of 178.3 tons/year. Per *Growth Offset Regulation*, 06-096 CMR 113 (as amended), major sources located within the geographical bounds of an area which is designated as nonattainment under the former one-hour federal ozone standard or under the eight-hour federal ozone standard, whichever is in effect, or in the Ozone Transport Region must obtain offset credits. This includes new sources whose emissions of a nonattainment pollutant are above the significant levels after the application of LAER. For Thermogen, reduction credits must be obtained for VOCs since the facility's proposed licensed VOC emissions are above the 50 tons per year significant emission levels and the source is located within the Ozone Transport Region, consisting of the entire State of Maine. The offset credits must be permanent, enforceable, surplus, real and quantifiable reductions.

Thermogen may use NO_X credits to offset VOC emissions to the extent allowed under the Clean Air Act and upon written notification of approval from the EPA, since the facility is located in an area of the State given a NO_X waiver under section182(f). The same number of offset credits must be obtained whether NO_X or VOC credits are used. All trades involving VOC offset credits or an increase in VOC emissions requiring offsets must be presented to the Board of Environmental Protection prior to Department approval and the offset credit reductions must be federally enforceable by the time the air emission license for the user is issued.

Thermogen has proposed to obtain NO_X offsets from the permanent shutdown of the MgO (Magnesium Oxide) Recovery Boiler at the GNP West, Inc. facility in Millinocket. Using the established VOC offset ratio of 1.15 to 1, Thermogen must obtain 205.05 tons of NO_X to offset the 178.3 ton VOC emissions, as shown below:

Required Offsets

Source	New Source Proposed VOC Licensed Emissions (TPY)	Minimum Offset Ratio per 06-096 CMR 113	Required Offsets (Tons)
Torrefied Wood Processing Facility (suspension burner, rotary dryer, TIES processor, and thermal oxidizer combustor)	178.3	1.15	205.01

Offset credits may be generated based on actual emission reductions for any consecutive 24-month period after May 31, 1994. MgO Recovery Boiler NO_X credits were calculated based on 2001 and 2002 continuous emissions monitoring (CEMs) data. 06-096 CMR 113, section 5(D) requires an adjustment to the base credit by applying a compliance assurance multiplier reflecting the method of measurement. Use of CEM data requires a 0.95 compliance assurance multiplier. The results of the offset calculations are presented in the following table:

Available NO_X Offsets from the GNP West, Inc. MgO Recovery Boiler

Year	Air Emission Inventory (06-096 CMR 137) NO_X Data, Tons	Measurement Method	Compliance Assurance Multiplier (06-096 CMR 113)	Total Available NO_X Offsets, Tons
2001	552.2	CEMS	0.95	524.6
2002	571.7	CEMS	0.95	543.1
				Average: 533.9

Per 06-096 CMR 113, section 4(C), offset credits are not allowed for reductions in emissions that were required by any federally enforceable license conditions developed pursuant to 40 CFR Parts 51, 52, 70, and 71, or other requirements of the Clean Air Act or other applicable federal or state law or requirement, including without limitation in achieving attainment of National Ambient Air Quality Standards or Reasonable Further Progress. The MgO Recovery Boiler would have been subject to the Best Available Retrofit Technology (BART) requirements of Section 169A of the Clean Air Act, applicable to specific source categories which began operation between August 7, 1962 and August 7, 1977 with a cumulative potential to emit of 250 tons per year or more of SO_2 or NO_X. However, based on the controls on the MgO Recovery Boiler and the BART findings of other units, it is expect that no additional NO_X controls on the MgO Recovery Boiler would have been required by BART.

06-096 CMR 113, section 4(K) allows the use of offset credits from shutdowns provided that the source using the offset credits demonstrates to the Department that the use of these offset credits will result in a net air quality benefit in Maine, as compared with emissions prior to the shutdown. The NO_X reductions from permanently shutting down the MgO Recovery Boiler from the GNP West, Inc. facility have not been previously accounted for or used in netting calculations.

The Department certifies that the NO_X emissions from the permanent shutdown of the GNP West, Inc. MgO Recovery Boiler can be used to offset the VOC emissions from the Thermogen facility. A license amendment submitted by GNP West, Inc. and Great Northern Paper Company, LLC to permanently retire the MgO Recovery Boiler and certify the emissions is currently in process at the Department. Thermogen has an agreement to acquire 205.05 tons of VOC offsets from GNP West, Inc. and Great Northern Paper Company, LLC and will provide this documentation to the Department upon offset certification.

G. Pellet Mill

The torrefied biomass will be pelletized following the TIES Processor. The pellet mill will consist of pelletizer equipment to form torrefied biomass into pellets, and then the pellets will be cooled via a series of conveyors and a pellet cooler. The pellet cooler system will exhaust through a high efficiency cyclone. The pelletizer cooling system will have an abort stack prior to the high efficiency cyclone.

Thermogen submitted a BACT analysis for PM from the pellet mill. Thermogen reviewed EPA's RACT/BACT/LAER Clearinghouse (RBLC) for recent New England pelletizer facilities. The following table contains the results of the RBLC review:

RBLC Information for Pelletizers

Facility	State	Equipment	Control Methods
Beaver Wood Energy Fair Haven, LLC	VT	115,000 ODT/yr Pellet Mill	Fabric Filter
Geneva Wood Fuels, LLC	ME	Pelletizer	Cyclone
Deposit Wood Pellet, LLC	NY	Four Pellet Mills	Multiple Cyclones & Two Baghouse
Maine Wood Pellets Company	ME	Three Pellet Mills	Dust Collection Cyclone & Baghouse
Woodstone NY, LLC	NY	Three Pellet Presses	Cyclone & Fabric Filter
Corinth Wood Pellets	ME	22 tons/hr Pellet Processing Operation	RAF Baghouse & Cyclone
Shuyler Wood Pellet, LLC	NY	Three Pellet Mils	Two Baghouses

1. BACT (Best Available Control Technology) Findings

   The following summarizes the PM BACT findings for the pellet mill emissions:

   PM - Particulate matter emissions will be generated in the pellet mill as the pellets are processed. Potential particulate matter controls for the pelletizer and pellet cooling system include fabric filters/baghouses and cyclones.

   Baghouses collect particulate matter on the surface of regularly cleaned/replaced filter bags and are commonly used to control particulate emissions from pelletizers. However, the torrefied wood cooling process will apply a significant amount of moisture to the wood, resulting in a high moisture content exhaust that could cause the fabric filters to plug up and lose functionality.

   Cyclones separate particles from gas streams using centripetal force. The use of a high efficiency cyclone has been selected for the proposed pelletizer and pellet cooling system.

   BACT for PM/PM_{10} emissions from the pelletizer and pellet cooling system is the use of a high efficiency cyclone and an emission rate of 0.5 lb/hr.

   Opacity – Visible emissions from the pelletizer and pellet cooling system stack shall not exceed 20% on a 6-minute block average basis, except for no more than one 6-minute block average in a one hour period.

   Additional BACT Findings –

   The exhaust from the pelletizer and pellet cooling system shall be directed to a high efficiency cyclone.

2. Periodic Monitoring -

   Thermogen shall keep a log documenting routine and unplanned maintenance on the high efficiency cyclone.

   Records shall be maintained documenting startups, shutdowns, and malfunctions. These records shall include dates, times, and duration of use of the pelletizer and pellet cooling system abort stack to document compliance with the 3 hour limit for each event.

H. General Process Emissions

Visible emissions from any general process source shall not exceed an opacity of 20% on a six (6) minute block average basis, except for no more than one (1) six (6) minute block average in a 1-hour period.

I. Fugitive Emissions

Visible emissions from a fugitive emission source (including stockpiles and roadways) shall not exceed an opacity of 20%, except for no more than five (5) minutes in any 1-hour period. Compliance shall be determined by an aggregate of the individual fifteen (15)-second opacity observations which exceed 20% in any one (1) hour.

J. Annual Emissions

1. Total Annual Emissions

Thermogen shall be restricted to the following annual emissions based on a 12-month rolling total. The tons per year limits were calculated based on a total fuel heat input of 52,560 MMBtu/yr, a facility processing rate of 184,788 ODT/yr, operating scenario #1 occurring at least 85% of the time, and operating scenario #2 occurring no more than 15% of the time (use of the suspension burner).

Total Licensed Annual Emissions for the Facility
Tons/year
(used to calculate the annual license fee)

	PM	PM_{10}	SO_2	NO_x	CO	VOC
Stack #1 (torrefication process)	21.9	21.9	0.1	69.1	55.5	178.3
Stack #2 (pellet mill)	2.2	2.2	n/a	n/a	n/a	n/a
Total TPY	**24.1**	**24.1**	**0.1**	**69.1**	**55.5**	**178.3**

2. Hazardous Air Pollutants (HAPs)

Thermogen has estimated HAPs to be below 9.9 tons per year of a single HAP and 24.9 tons per year total combined HAPs, classifying the facility as an area source for HAPs. Emissions were calculated using National Council on Air and Stream Improvement (NCASI) published emission factors for oriented strand board wood-fired rotary dryers with particulate matter control, except formaldehyde for which the emission factor was based on the manufacturer's guarantee. Thermogen has proposed to conduct initial HAP verification testing within 180 days of commencing operating scenario #1.

3. Greenhouse Gases

Greenhouse gases are considered regulated pollutants as of January 2, 2011, through 'Tailoring' revisions made to EPA's *Approval and Promulgation of Implementation Plans,* 40 CFR Part 52, Subpart A, §52.21 Prevention of Significant Deterioration of Air Quality rule. Greenhouse gases, as defined in 06-096 CMR 100 (as amended), are the aggregate group of the following gases: Carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. For licensing purposes, greenhouse gases (GHG) are calculated and reported as carbon dioxide equivalents (CO_2e).

Based on the facility's operating limits; GHG emission factors and global warming potentials applied to the wood fuel use from the burner and the biomass heat capacity entering and exiting the TIES Processor; and GHG emission factors and global warming potentials applied to the propane fuel use, Thermogen is below the major source threshold of 100,000 tons of CO_2e per year. It was calculated that GHG emissions from Thermogen are no greater than 63,100 tons per year, taking into account the total of CO_2, N_2O, and CH_4 from the facility. Therefore, no additional licensing requirements are needed to address GHG emissions at this time.

III. AMBIENT AIR QUALITY ANALYSIS

A. Overview

Maine DEP's interpretation of 06-096 CMR 115 Ambient Air Quality Analysis requirements for Thermogen is that a modeling analysis is not required since the source is major only for VOCs (a pollutant not included in point source modeling analyses) and the source is below modeling cutoff threshold levels listed in 06-096 CMR 115 for PM_{10}, SO_2, NO_X, and CO. However, the facility did perform a modeling analysis for their own internal purposes to assure that the project would meet ambient air quality standards. In response to EPA's comments on the draft license, the ambient air quality analysis has been included in the license for information purposes.

A refined modeling analysis was performed to show that emissions from Thermogen, in conjunction with other sources, will not cause or contribute to violations of National Ambient Air Quality Standards (NAAQS) for SO_2, PM_{10}, $PM_{2.5}$, NO_2 or CO or to Class II increments for SO_2, PM_{10}, $PM_{2.5}$ or NO_2.

Based upon the magnitude of proposed emissions increase and the distance from the source to any Class I area, the affected Federal Land Managers (FLMs) and MEDEP-BAQ have determined that an assessment of Class I Air Quality Related Values (AQRVs) is not required.

B. Model Inputs

The AERMOD-PRIME refined model was used to address standards and increments in all areas. If applicable, the modeling analysis accounted for the potential of building wake and cavity effects on emissions from all modeled stacks that are below their calculated formula GEP stack heights.

All modeling was performed in accordance with all applicable requirements of the Maine Department of Environmental Protection, Bureau of Air Quality (MEDEP-BAQ) and the United States Environmental Protection Agency (USEPA).

A valid 5-year hourly on-site meteorological database was used in the AERMOD-PRIME refined modeling analysis. The following parameters and their associated heights were collected at the Great Northern Paper meteorological monitoring site during the 5-year period 1990-1993 and July 1, 1994 – June 30, 1995:

TABLE III-1 : Meteorological Parameters and Collection Heights

Parameter	Sensor Height(s)
Wind Speed	10 meters, 90 meters
Wind Direction	10 meters, 90 meters
Standard Deviation of Wind Direction (Sigma A)	10 meters, 90 meters
Temperature	3 meters

Per USEPA guidance, any small gaps (two hours or less) of missing on-site data were filled in using linear interpolation. Larger gaps of missing data (three or more hours) were coded as missing.

In addition, hourly Bangor NWS data, from the same time period, were used to supplement the primary surface dataset for the required variables (cloud cover and ceiling height) that were not explicitly collected at the Great Northern Paper meteorological monitoring site. Concurrent upper-air data from the Caribou NWS site were also used in the analysis. Missing cloud cover and/or upper-air data values were interpolated or coded as missing, per USEPA guidance.

All necessary representative micrometeorological surface variables for inclusion into AERMET (surface roughness, Bowen ratio and albedo) were calculated using AERSURFACE from procedures recommended by USEPA.

Point-source parameters, used in the modeling for Thermogen are listed in Table III-2.

TABLE III-2 : Point Source Stack Parameters

Facility/Stack	Stack Base Elevation (m)	Stack Height (m)	GEP Stack Height (m)	Stack Diameter (m)	UTM Easting NAD83 (km)	UTM Northing NAD83 (km)
CURRENT/PROPOSED						
Thermogen						
• Stack #1	118.87	45.27	42.72	1.52	522.843	5054.870

Emission parameters for NAAQS and increment modeling are listed in Table III-3. For the purposes of determining PM_{10} and $PM_{2.5}$ impacts, all PM emissions were conservatively assumed to convert to PM_{10} and $PM_{2.5}$. For the purpose of determining NO_2 impacts, all NO_x emissions were conservatively assumed to convert to NO_2.

TABLE III-3 : Stack Emission Parameters

Facility/Stack	Averaging Periods	SO_2 (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NO_2 (g/s)	CO (g/s)	Stack Temp (K)	Stack Velocity (m/s)
MAXIMUM LICENSE ALLOWED								
Thermogen								
• Stack #1 – Normal High	All	0.0015	0.49	0.49	1.64	1.39	350.90	12.18
• Stack #1 – Normal Medium	All	0.0014	0.42	0.42	1.64	1.01	361.50	10.63
• Stack #1 – Normal Low	All	0.0013	0.35	0.35	1.64	0.76	430.90	12.16
• Stack #1 – Startup High	All	0.0013	1.42	1.42	3.97	2.78	558.70	23.92
• Stack #1 – Startup Medium	All	0.0011	1.18	1.18	3.47	2.00	579.80	22.54
• Stack #1 – Startup Low	All	0.0010	1.06	1.06	3.05	1.50	602.00	21.37
BASELINE – 1987								
Thermogen								
• No sources existed in the 1987 baseline year; no baseline credit to be taken.								
BASELINE – 1977								
Thermogen								
• No sources existed in the 1977 baseline year; no baseline credit to be taken.								

C. <u>Single Source Modeling Impacts</u>

AERMOD-PRIME refined modeling was performed for a total of six operating scenarios that represented a range of normal and start-up operations. Modeling results for Thermogen alone are shown in Table III-4. It is important to note that predicted impacts for all pollutants/averaging periods are based on the highest-first-high (H1H) concentration from all five years of meteorological data. Therefore, the results are overly conservative.

Maximum predicted impacts that exceed their respective significance level are indicated in boldface type. No further modeling was required for pollutant/terrain combinations that did not exceed their respective significance levels.

TABLE III-4 : Maximum AERMOD-PRIME Impacts from Thermogen Alone

Pollutant	Averaging Period	Max Impact[a] (µg/m³)	Class II Significance Level (µg/m³)	Receptor UTM E (km)	Receptor UTM N (km)	Receptor Elevation (m)	Load Case
SO_2	1-hour	0.032	**10[b]**	519.000	5057.000	209.39	Normal High
	3-hour	0.013	**25**	519.000	5057.000	209.39	Normal High
	24-hour	0.003	**5**	522.600	5054.450	151.42	Normal High
	Annual	0.001	**1**	522.840	5055.310	114.62	Normal High
PM_{10}	24-hour	1.33	**5**	522.550	5054.400	151.38	Startup High
	Annual	0.06	**1**	522.840	5055.310	114.62	Normal High
$PM_{2.5}$	24-hour	**1.33**	**1.2**	522.550	5054.400	151.38	Startup High
	Annual	0.06	**0.3**	522.840	5055.310	114.62	Normal High
NO_2	1-hour	**35.84**	**10[c]**	519.000	5057.000	209.39	Normal Medium
	Annual	0.20	**1**	522.840	5055.310	114.62	Normal Medium
CO	1-hour	29.29	**2000**	519.000	5057.000	209.39	Normal High
	8-hour	7.73	**500**	521.313	5047.177	228.62	High Start

[a] Values based on the H1H (highest-1st-high) concentration from five years of meteorological data
[b] Interim Significant Impact Level (SIL) adopted by Maine
[c] Interim Significant Impact Level (SIL) adopted by NESCAUM states

D. Combined Source Modeling Impacts

For predicted modeled impacts from Thermogen alone that exceeded significance levels, as indicated in boldface type in Table III-4, other sources not explicitly included in the modeling analysis must be accounted for by using representative background concentrations for the area.

Background concentrations, listed in Table III-5, are derived from representative rural background data for use in the Eastern Maine region.

TABLE III-5 : Background Concentrations

Pollutant	Averaging Period	Background Concentration (µg/m³)
$PM_{2.5}$	24-hour	17[a]
NO_2	1-hour	49[b]

[a] MacFarland Hill Site _Acadia National Park
[b] MicMac Site - Presque Isle

MEDEP examined other area sources whose impacts would be significant in or near Thermogen's significant impact area. Due to the applicant's location, extent of the significant impact area and other nearby source emissions, MEDEP has determined that no other sources would be considered for combined source modeling.

For pollutant averaging periods that exceeded significance levels, the maximum modeled impacts were added with conservative rural background concentrations to demonstrate compliance with NAAQS, as shown in Table III-6. Because impacts for all pollutants using this method meet all NAAQS, no further modeling analyses need to be performed.

TABLE III-6 : Maximum Predicted Impacts with Background

Pollutant	Averaging Period	Max Impact (μg/m³)	Receptor UTM E (km)	Receptor UTM N (km)	Receptor Elevation (m)	Back-Ground (μg/m³)	Max Total Impact (μg/m³)	NAAQS (μg/m³)
$PM_{2.5}$	24-hour	**1.33**	522.550	5054.400	151.38	**17**	**18.33**	**196**
NO_2	1-hour	**35.84**	519.000	5057.000	209.39	**49**	**84.84**	**188**

E. Increment

AERMOD-PRIME refined modeling was performed to predict the maximum Class II increment impacts. Thermogen did not exist during the 1987 or 1977 baseline years, so their emissions are considered to be entirely increment consuming. In addition, Thermogen conservatively assumed no credit would be taken from any other area sources that existed during the baseline years.

Results of the Class II increment analysis are shown in Table III-7. All modeled maximum increment impacts were below all increment standards. Because all predicted increment impacts meet increment standards, no further Class II increment modeling needed to be performed.

TABLE III-7 : Class II Increment Consumption

Pollutant	Averaging Period	Max Impact (μg/m³)	Class II Increment (μg/m³)	Receptor UTM E (km)	Receptor UTM N (km)	Receptor Elevation (m)
SO_2	3-hour	0.013	**512**	519.000	5057.000	209.39
	24-hour	0.003	**91**	522.600	5054.450	151.42
	Annual	0.001	**20**	522.840	5055.310	114.62
PM_{10}	24-hour	1.33	**30**	522.550	5054.400	151.38
	Annual	0.06	**17**	522.840	5055.310	114.62
$PM_{2.5}$	24-hour	1.33	**9**	522.550	5054.400	151.38
	Annual	0.06	**4**	522.840	5055.310	114.62
NO_2	Annual	0.20	**25**	522.840	5055.310	114.62

As part of the increment analysis, impacts that would occur as a direct result of the general, commercial, residential, industrial and mobile-source growth associated with the construction and operation of a source were evaluated as follows:

GENERAL GROWTH: Some increases in local emissions due to construction related activities are expected to occur for several months, with the majority of emissions due to truck traffic (soil removal, concrete delivery/pouring, delivery of materials, etc.). Increases in potential emissions of NO_X due to commuting by construction workers will likely be temporary and short-lived. Emissions of dust from construction related activities will be minimized by the use of "Best Management Practices" for construction on-site.

RESIDENTIAL, COMMERCIAL AND INDUSTRIAL GROWTH: Population growth in the impact area of the proposed source can be used as a surrogate factor for the growth in emissions from residential combustion sources. Construction of Thermogen is expected to create approximately 25 new full-time jobs. The manpower requirements, operations and support required for the construction and operation of Thermogen will, for the most part, be available from the surrounding communities. It is expected that no new significant residential, commercial and industrial growth will follow from the modification associated with this source.

MOBILE SOURCE AND AREA SOURCE GROWTH: Since area and mobile sources are considered minor sources of NO_2, their contribution to increment has to be considered. Technical guidance from USEPA points out that screening procedures can be used to determine whether additional detailed analyses of minor source emissions are required. Compiling a minor source inventory may not be required if it can be shown that little or no growth has taken place in the impact area of the proposed source since the baseline dates (1977/1988) were established. Very little growth has taken place in the area of Thermogen since the baseline dates were established. In addition, no increase in Vehicle Miles Travelled (VMT) is expected as a result of the modification. No further analyses of mobile or area source growth are needed.

F. <u>Class I Analyses</u>

Based upon the magnitude of proposed emissions increase and the distance from the source to any Class I area, the affected Federal Land Managers (FLMs) and MEDEP-BAQ have determined that an assessment of Class I Air Quality Related Values (AQRVs) is not required.

G. Summary

In summary, it has been demonstrated that Thermogen will not cause or contribute to a violation of any NAAQS for SO_2, PM_{10}, $PM_{2.5}$, NO_2 or CO; or any SO_2, PM_{10}, $PM_{2.5}$ or NO_2 Class II increment standards.

ORDER

Based on the above Findings and subject to conditions listed below, the Department concludes that the emissions from this source:

- will receive Best Practical Treatment,
- will not violate applicable emission standards, and
- will not violate applicable ambient air quality standards in conjunction with emissions from other sources.

The Department hereby grants Air Emission License A-1072-77-1-N subject to the following conditions.

Severability. The invalidity or unenforceability of any provision, or part thereof, of this License shall not affect the remainder of the provision or any other provisions. This License shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

STANDARD CONDITIONS

(1) Employees and authorized representatives of the Department shall be allowed access to the licensee's premises during business hours, or any time during which any emissions units are in operation, and at such other times as the Department deems necessary for the purpose of performing tests, collecting samples, conducting inspections, or examining and copying records relating to emissions (38 M.R.S.A. §347-C).

(2) The licensee shall acquire a new or amended air emission license prior to commencing construction of a modification, unless specifically provided for in Chapter 115. [06-096 CMR 115]

(3) Approval to construct shall become invalid if the source has not commenced construction within eighteen (18) months after receipt of such approval or if construction is discontinued for a period of eighteen (18) months or more. The Department may extend this time period upon a satisfactory showing that an extension is justified, but may condition such extension upon a review of either

the control technology analysis or the ambient air quality standards analysis, or both. [06-096 CMR 115]

(4) The licensee shall establish and maintain a continuing program of best management practices for suppression of fugitive particulate matter during any period of construction, reconstruction, or operation which may result in fugitive dust, and shall submit a description of the program to the Department upon request. [06-096 CMR 115]

(5) The licensee shall pay the annual air emission license fee to the Department, calculated pursuant to Title 38 M.R.S.A. §353-A. [06-096 CMR 115]

(6) The license does not convey any property rights of any sort, or any exclusive privilege. [06-096 CMR 115]

(7) The licensee shall maintain and operate all emission units and air pollution systems required by the air emission license in a manner consistent with good air pollution control practice for minimizing emissions. [06-096 CMR 115]

(8) The licensee shall maintain sufficient records to accurately document compliance with emission standards and license conditions and shall maintain such records for a minimum of six (6) years. The records shall be submitted to the Department upon written request. [06-096 CMR 115]

(9) The licensee shall comply with all terms and conditions of the air emission license. The filing of an appeal by the licensee, the notification of planned changes or anticipated noncompliance by the licensee, or the filing of an application by the licensee for a renewal of a license or amendment shall not stay any condition of the license. [06-096 CMR 115]

(10) The licensee may not use as a defense in an enforcement action that the disruption, cessation, or reduction of licensed operations would have been necessary in order to maintain compliance with the conditions of the air emission license. [06-096 CMR 115]

(11) In accordance with the Department's air emission compliance test protocol and 40 CFR Part 60 or other method approved or required by the Department, the licensee shall:

A. perform stack testing to demonstrate compliance with the applicable emission standards under circumstances representative of the facility's normal process and operating conditions:

   1. within sixty (60) calendar days of receipt of a notification to test from the Department or EPA, if visible emissions, equipment operating parameters, staff inspection, air monitoring or other cause indicate to the Department

that equipment may be operating out of compliance with emission standards or license conditions; or
2. pursuant to any other requirement of this license to perform stack testing.

B. install or make provisions to install test ports that meet the criteria of 40 CFR Part 60, Appendix A, and test platforms, if necessary, and other accommodations necessary to allow emission testing; and

C. submit a written report to the Department within thirty (30) days from date of test completion.

[06-096 CMR 115]

(12) If the results of a stack test performed under circumstances representative of the facility's normal process and operating conditions indicate emissions in excess of the applicable standards, then:

A. within thirty (30) days following receipt of such test results, the licensee shall re-test the non-complying emission source under circumstances representative of the facility's normal process and operating conditions and in accordance with the Department's air emission compliance test protocol and 40 CFR Part 60 or other method approved or required by the Department; and

B. the days of violation shall be presumed to include the date of stack test and each and every day of operation thereafter until compliance is demonstrated under normal and representative process and operating conditions, except to the extent that the facility can prove to the satisfaction of the Department that there were intervening days during which no violation occurred or that the violation was not continuing in nature; and

C. the licensee may, upon the approval of the Department following the successful demonstration of compliance at alternative load conditions, operate under such alternative load conditions on an interim basis prior to a demonstration of compliance under normal and representative process and operating conditions.

[06-096 CMR 115]

(13) Notwithstanding any other provisions in the State Implementation Plan approved by the EPA or Section 114(a) of the CAA, any credible evidence may be used for the purpose of establishing whether a person has violated or is in violation of any statute, regulation, or Part 70 license requirement. [06-096 CMR 115]

(14) The licensee shall maintain records of malfunctions, failures, downtime, and any other similar change in operation of air pollution control systems or the emissions unit itself that would affect emission and that is not consistent with the terms and conditions of the air emission license. The licensee shall notify the Department within two (2) days or the next state working day, whichever is later, of such occasions where such changes result in an increase of emissions. The licensee shall report all excess emissions in the units of the applicable emission limitation. [06-096 CMR 115]

(15) Upon written request from the Department, the licensee shall establish and maintain such records, make such reports, install, use and maintain such monitoring equipment, sample such emissions (in accordance with such methods, at such locations, at such intervals, and in such a manner as the Department shall prescribe), and provide other information as the Department may reasonably require to determine the licensee's compliance status. [06-096 CMR 115]

SPECIFIC CONDITIONS

(16) **Torrefication Process**

A. Operating Scenarios
   1. During operating scenario #1, a portion of the emissions from the TIES Processor Thermal Oxidizer Combustor shall exhaust to the Rotary Dryer and all Rotary Dryer emissions shall exhaust to the cyclone, the Wet ESP and exit through Stack #1. The exception is during startup, shutdown, or malfunction as specified in Condition (16)(J).
   2. During operating scenario #2, the Rotary Dryer suspension burner may be used and all Rotary Dryer emissions shall exhaust to the cyclone, the Wet ESP, and exit out Stack #1; emissions from the TIES Processor Thermal Oxidizer Combustor shall exhaust out Stack #1 via a tie-in located after the Wet ESP. The exception is during startup, shutdown, or malfunction as specified in Condition (16)(J).

   [06-096 CMR 115, BACT]

B. Commencement of Operations

   Commencement of operating scenario #1 shall be defined as when the TIES Processor Thermal Oxidizer Combustor gases are used as the sole heat source of the Rotary Dryer and the facility is producing torrefied woody biomass pellets. Operating scenario #1 commencement shall occur within 180 days of first fire of the suspension burner. First fire shall be defined as the commencement of suspension burner and Rotary Dryer operation while drying woody biomass. [06-096 CMR 115, BACT]

C. Rotary Dryer
   1. Rotary Dryer Processing Rate
      a. The Rotary Dryer shall not exceed a processing rate of 184,788 tons per year of wood at 0% moisture content basis, based on a 12-month rolling total.
      b. Rotary Dryer process rate records shall be kept on a monthly and 12-month rolling total basis. The processing rate shall be determined by raw material consumption based on wood delivery receipts, recorded moisture content, and/or Rotary Dryer feed metering.

      [06-096 CMR 115, BACT]
   2. Rotary Dryer Temperature Monitoring

a. A temperature monitoring system shall be installed, operated, maintained, and calibrated on the Rotary Dryer in accordance with the manufacturer's recommendation.
b. The inlet temperature of the Rotary Dryer shall be monitored and recorded on a continuous basis for a minimum of 98% of the time the dryer is operating and must record accurate and reliable data. The inlet temperature records shall include the temperature, date, and time. For the purpose of this requirement, continuous shall be defined as at least two data points every 15 minutes.
c. If the parameter monitor is recording accurate and reliable data less than 98% of the source operating time within any quarter of the calendar year, the Department may initiate enforcement action and may include in that enforcement action any period of time that the parameter monitor was not recording accurate and reliable data during that quarter unless the licensee can demonstrate to the satisfaction of the Department that the failure of the system to record accurate and reliable data was due to the performance of established quality assurance and quality control procedures or unavoidable malfunctions.

[06-096 CMR 115, BACT]

3. Emissions from the Rotary Dryer shall be directed through the cyclone and wet ESP, except during startup, shutdown, or malfunction as specified in Condition (16)(J). [06-096 CMR 115, BACT]

D. Suspension Burner
1. Fuel
a. The suspension biomass burner shall be limited to a total fuel heat input capacity of 52,560 MMBtu/yr (equivalent to 1314 hours/year at maximum firing rate or 15% of annual capacity), and shall take effect following commencement of operating scenario #1. The total fuel heat input capacity limit shall also include the small amount of propane used in the burner.
b. Records shall be maintained documenting fuel use on a monthly basis, and total fuel heat input on a monthly and a 12-month rolling total basis. This includes wood and propane use.
c. Clean wood/woody biomass materials consisting of wood chips, bark, shavings, and sawdust shall be fired in the suspension burner.
2. Emissions from the suspension burner shall be directed through the Rotary Dryer and associated cyclone and Wet ESP, except during startup, shutdown, or malfunction as specified in Condition (16)(J).

[06-096 CMR 115, BACT]

E. TIES (Targeted Intelligent Energy System) Processor
1. Emissions from the TIES Processor shall be exhausted through the Thermal Oxidizer Combustor, except during startup, shutdown, or malfunction as specified in Condition (16)(J).

2. Propane use records for the TIES Processor Thermal Oxidizer Combustor shall be maintained.
3. Thermogen shall comply with any applicable requirements of 40 CFR Part 60, including notification and recordkeeping. The following address for EPA shall be used for any reports or notifications required to be copied to them:

   Compliance Clerk
   USEPA Region 1
   5 Post Office Sq. Suite 100
   Boston, MA 02109-3912

[06-096 CMR 115, BACT]

F. Emissions from Stack #1 shall not exceed the following as determined by stack testing [06-096 CMR 115, BACT] :

Emission Limits from Stack #1

Operating Scenario	PM lb/hr	PM_{10} lb/hr	SO_2 lb/hr	NO_X lb/hr	CO lb/hr	VOC lb/hr
Operating Scenario #1 (Heat derived exclusively from the TIES thermal oxidizer combustor)	3.9	3.9	0.01	13.0	11.0	40.7
Operating Scenario #2 (Heat derived from the suspension burner (also includes TIES combustor emissions entering the stack after the wet ESP))	11.3	11.3	0.01	31.5	22.1	33.9

G. Visible emissions from Stack #1 shall not exceed 30% opacity on a 6-minute block average, except for no more than two 6-minute block averages in a continuous three hour period. [06-096 CMR 115, BACT]

H. Facility-Wide PM and VOC Emissions

1. Emissions from the facility shall not exceed the following:

Pollutant	TPY
PM	24.1
VOC	178.3

2. Thermogen shall maintain records documenting compliance with the tons/year emission limits on a 12 month rolling total basis, including abort stack emissions.

[06-096 CMR 115, BACT]

I. Stack #1 shall be at least 150 feet above ground level. [06-096 CMR 115, BACT]

J. Start Startup, Shutdown, and Malfunction
   1. During startup, shutdown, or malfunction, the abort stacks may be used for the Rotary Dryer, the TIES Processor, and/or the Thermal Oxidizer Combustor for no more than 3 hours for any event.
   2. Records shall be maintained documenting startups, shutdowns, and malfunctions. These records shall include dates, times, and duration of use of the rotary dryer, TIES Processor, and Thermal Oxidizer Combustor abort stacks to document compliance with the 3 hour limit for each event.

   [06-096 CMR 115, BACT]

K. Submittals

   Within 180 days of commencing operating scenario #1 (TIES Processor Thermal Oxidizer gases used as the sole heat source of the Rotary Dryer and producing torrefied woody biomass pellets), Thermogen shall submit the following to the Department:
   1. A startup, shutdown, and malfunction plan to the Department detailing emissions, procedures, and timeframes for these events, including the abort stacks use and emissions.
   2. A proposed opacity limit for the abort stacks.
   3. Documentation on the Rotary Dryer inlet temperature parameter values. The inlet temperature parameters shall ensure proper operating conditions of the dryer.
   4. A plan detailing Wet ESP parameter values and monitoring frequency to the Department for approval. These parameters shall ensure proper operating conditions of the Wet ESP.
   5. A plan detailing Thermal Oxidizer Combustor parameter values and monitoring frequency to the Department for approval. These parameters shall ensure proper operating conditions of the Thermal Oxidizer Combustor.

   [06-096 CMR 115, BACT]

L. Following submittal of the plans required in Condition (16)(J) and after notification from the Department, Thermogen shall submit a license application to incorporate the specifics of the facility's operations during startup and shutdowns and parameter requirements for the Rotary Dryer's inlet temperature, the Wet ESP, and the TIES Processor Thermal Oxidizer Combustor into the license, as appropriate. [06-096 CMR 115, BACT]

M. Stack Testing
   1. Within 180 days of commencing operating scenario #1 (TIES Processor Thermal Oxidizer Combustor gases used as the sole heat source for the Rotary Dryer and producing torrefied woody biomass pellets), Thermogen

shall perform stack tests on Stack #1 for PM, NO_X, CO, and VOC to determine compliance with the licensed emission limits using the EPA stack test methods specified in the table below, or other methods approved by the Department. [06-096 CMR 115, BACT]

Pollutant	EPA Test Method
PM	Method 5
SO_2	Method 6C
NO_X	Method 7E
CO	Method 10
VOC	Methods 18 & 25A

2. Within 180 days of commencing operating scenario #1 (TIES Processor Thermal Oxidizer Combustor gases used as the sole heat source for the Rotary Dryer and producing torrefied woody biomass pellets), Thermogen shall conduct initial HAP verification testing on the process exhaust gases using the appropriate EPA stack test methods or other methods approved by the Department. [06-096 CMR 115, BACT]

(17) **Pellet Mill**

A. Emissions from the pelletizer and pellet cooling system stack shall not exceed [06-096 CMR 115, BACT] :

	lb/hr
PM	0.5
PM_{10}	0.5

B. Visible emissions from the pelletizer and pellet cooling system stack shall not exceed 20% on a 6-minute block average basis, except for no more than one 6-minute block average in a one hour period. [06-096 CMR 115, BACT]

C. Pelletizer and Pellet Cooling System Control Requirements

1. The pelletizer and pellet cooling system shall be controlled through the use of a high efficiency cyclone.
2. A maintenance log shall be kept documenting routine and unplanned maintenance on the high efficiency cyclone, including dates, times, and maintenance performed.

[06-096 CMR 115, BACT]

(18) **Offsets**

Thermogen shall obtain 205.05 tons of certified offset credits (NO_X or VOC) for the 178.3 tons of VOC licensed emissions (at the 1.15 to 1 ratio). The offset credit reduction must be federally enforceable by the time this air license is issued. [06-096 CMR 113]

(19) **General Process Emissions**
Visible emissions from any general process source shall not exceed an opacity of 20% on a six (6) minute block average basis, except for no more than one (1) six (6) minute block average in a 1-hour period. [06-096 CMR 101]

(20) **Fugitive Emissions**

Visible emissions from a fugitive emission source (including stockpiles and roadways) shall not exceed an opacity of 20%, except for no more than five (5) minutes in any 1-hour period. Compliance shall be determined by an aggregate of the individual fifteen (15)-second opacity observations which exceed 20% in any one (1) hour. [06-096 CMR 101]

(21) **Annual Emission Statement**

In accordance with *Emission Statements*, 06-096 CMR 137 (as amended), the licensee shall annually report to the Department the information necessary to accurately update the State's emission inventory by means of either:

1) A computer program and accompanying instructions supplied by the Department; or
2) A written emission statement containing the information required in 06-096 CMR 137.

The emission statement must be submitted as specified by the date in 06-096 CMR 137.

(22) Thermogen shall notify the Department within 48 hours and submit a report to the Department on a <u>quarterly basis</u> if a malfunction or breakdown in any component causes a violation of any emission standard (38 M.R.S.A. §605).

(23) Thermogen shall apply for a Part 70 license within 12 months of commencing operation under the proposed scenario as provided in 40 CFR Part 70.5. [06-096 CMR 140, Section 2(J)(2)(c)]

DONE AND DATED IN AUGUSTA, MAINE THIS 24th DAY OF September, 2012.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY: Melanie Loyzim for
PATRICIA W. AHO, COMMISSIONER

PLEASE NOTE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES

Date of initial receipt of application: May 25, 2012
Date of application acceptance: May 29, 2012

Date filed with the Board of Environmental Protection:

Filed
SEP 24 2012
State of Maine
Board of Environmental Protection

This Order prepared by Kathleen E. Tarbuck, Bureau of Air Quality.